

QHeatNet: A Thermodynamic Framework for Faster-Than-Light Quantum Information Transfer

Abstract

This paper proposes a novel theoretical framework—QHeatNet—wherein quantum entanglement and information transfer are facilitated not through traditional particle or photonic channels, but via an underlying thermodynamic field established by the Cosmic Microwave Background (CMB). We hypothesize that this thermal substrate, which predates photon decoupling, serves as a pre-spacetime lattice enabling synchronized state updates between entangled systems across arbitrary distances, bypassing light-speed constraints. This model leverages entropy gradients and coherent thermal oscillations as the foundational medium for quantum information linkage. Implications for quantum networking, FTL signaling limitations, and entropy-based computation are discussed.

1. Introduction

Modern quantum information theory relies on entangled particles, photonic pathways, and superconducting channels to enable quantum networking. However, these approaches remain bounded by physical constraints including coherence distance, error rates, and fundamentally, the speed of light (c). This paper introduces QHeatNet—a thermodynamic architecture that operates outside of light-speed-limited channels. We explore whether the CMB's uniformly distributed thermal energy can serve as a background lattice for quantum state linkage, offering a nonlocal synchronization mechanism that is both physically embedded and informationally active.

2. Thermodynamic Substrate of Entanglement

The early universe was a superheated plasma in which all particles and fields interacted via thermal exchange. Long before photons decoupled ($\sim 380,000$ years post-Big Bang), entropy gradients and thermal turbulence encoded spatial and probabilistic structure. This field—persisting today as the CMB—may act as a distributed, isotropic medium in which entangled quantum states share a common thermal signature. Since entropy is a measure of information uncertainty, thermal coherence in this field may permit quantum state mirroring without direct energy transmission.

3. Mathematical Framework

Consider two entangled states A and B, separated by distance D . Traditional models rely on a shared wavefunction $\Psi(A,B)$ with collapse interpreted upon measurement. Let us define a shared entropy field $E(x,t)$ rooted in the CMB's uniformity:

$$E(x,t) = \nabla S(x,t) / k_B$$

where S is the local entropy gradient and k_B is Boltzmann's constant. Let information $I(A \leftrightarrow B)$ be embedded as phase-aligned fluctuations $\Delta T(x,t)$ across $E(x,t)$.

Then, the information transfer delay T_{delay} approaches zero as:

$$T_{\text{delay}} \approx \lim_{(D \rightarrow \infty)} [\Delta x / v \Delta T] \rightarrow 0$$

if ΔT is mediated across a pre-established $E(x,t)$ substrate rather than propagating via c-bound photon exchange. Thus, the transmission is effectively instantaneous—not by signal, but by field-wide phase adjustment.

4. Implications for FTL Communication

If QHeatNet proves valid, it offers a path to true quantum networking across astronomical distances, without the need for entanglement chains, quantum repeaters, or traditional media. Information encoded in thermal gradients or entropy fluctuations could bypass current quantum decoherence issues by embedding logic states in the very thermal structure of spacetime. This would radically alter our understanding of quantum locality, cosmological information theory, and communication infrastructure.

5. Conclusion

We have presented QHeatNet, a speculative yet grounded proposal for using thermodynamic coherence and the CMB as a substrate for nonlocal, light-speed-independent quantum information transfer. This approach, if supported by experimental or cosmological modeling, could represent a new category of quantum information science—rooted not in exotic particles or superconductors, but in the foundational heat of the universe itself.

References

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